DUXBURY BEACH

Duxbury Clipper, Thursday, June 26, 1975

HISTORY OF DUXBURY BEACH

Sue Amory

(For her master of arts in teaching, Sue Amory wrote **A Geological, Ecological and Man-Made History of Duxbury Beach - Past, Present and Future.** The following is a condensed version of her thesis -- Ed.)

Thirty-five miles southeast of Boston, there is a 4½ mile stretch of barrier beach extending into Massachusetts Bay. It is bordered by Marshfield on the north and Plymouth on the south. It not only has served as a recreational and scenic area, but more importantly as a natural breakwater. This barrier beach is Duxbury Beach.

Duxbury Beach is owned by the Duxbury Beach Association -- a non-profit, common law trust organized in 1919 for the purpose of acquiring the beach and protecting it for the benefit of Duxbury.

Duxbury Beach, separating Duxbury Harbor and Duxbury Bay from the open ocean, provides the only protection to the inner estuarine system and human habitation along its shores from fall hurricanes and winter storms. A barrier beach is uniquely rugged and relatively stable when subjected to disturbance from natural forces.

However, during recent years the beach has been subjected to increasingly heavy recreational use by man. As a consequence there has been loss of vegetation, on which the stability of the beach depends, and thus the beach has become a fragile, exposed strip of sand extremely susceptible to erosive forces.

Today, there is concern over the possible loss of Duxbury Beach. In 1972, the Duxbury beach study committee stated in a letter to selectmen: "The beach is perhaps Duxbury's most important natural resource, the one in greatest danger....A beach will continue during our lifetime, but within a decade, the dunes as we know them will largely disappear."

Sporadic efforts for erosion control on Duxbury Beach began as early as the 1930s, but it was not actually until after 2 serious Northeasters, one in 1967 and one in 1972, that conservation measures for dune and beach stabilization were begun. Today, only through such dedication and loyalty of the Duxbury residents, Duxbury Beach seems to be in quite a successful state of restoration. But the question still remains: Will the newly-stabilized dune system on Duxbury Beach survive future storms?

A Natural History

It was 30,000 or 40,000 years ago when New England experienced the final advance of a great continental ice sheet. The glacier pushed southward from the Bay of Maine and inland New England, moving to southeastern Massachusetts and to the off shore islands of Nantucket and Martha's Vineyard. New England was covered for thousands of years by this last glacier.

As the climate gradually warmed, the glacier ceased its southward advance and slowly began to melt and recede. Long, undulating mounds of earth, called terminal moraines, created by the southward movement of the glacier, were left behind. Behind the terminal moraines, land which had been pushed down by the weight of the overlying glacier slowly rose. With the rise in sea level caused by melting ice, the terminal moraines along the coast became surrounded by water, forming glacial islands.

It was from such a terminal moraine forming a series of broken islands as sea level rose that Duxbury Beach began to develop.

With exposure to the sea, eroded materials from the terminal moraines collected to form "spits." With continued build-up of sand and gravel, transported from morainal deposits by tidal currents, these sand spits formed connecting links between the glacial islands, which today are known as Saquish Head and Gurnet Point, and the mainland at Green Harbor. The process of beach-building never stopped.

After thousands of years of accumulation in broad, flat areas of the beach, sand reached an elevation in which its upper levels were dry for most of the year. Sand particles carried up from the beach by wind began to accumulate against such obstacles as rocks or driftwood. This marked the beginning of the dune-building process.

Seeds, carried by wind and birds, developed into beach grasses on the protected back side of the developing sand mounds. As sand carried by the wind accumulated around the beach plants, the sand mounds developed into dunes. The typical dune had a gentle slope facing the prevailing wind, a crest, and a steep slope at its back side.

Dunes move slowly downwind, migrating with the wind; during windy periods, sand is blown up the gentle slope of the dune and dropped over the dune crest down the lee side. However, with beach grasses, a primary anchoring mechanism for the dunes was provided.

As sand accumulated around the base of the beach grasses, stems lengthened to raise leaves above the sand, and roots extended deep into the ground, forming a dense mat. This dense mat helped to stabilize the dunes. As the growth and death of the leaves and stems combined to form humus and, eventually, a soil, an environment capable of stimulating plant life of the next seral stage of dune succession was created. In the less exposed areas of the barrier beach, succession progressed from clumps of beach grass, to shrub communities, and finally to forests. Each seral stage modified the environment in some way, providing a suitable environment for the succeeding stage.

Changes in vegetative stages brought different animal associations. As plant associations succeeded one another, greater stabilization was achieved; with a complete plant cover, including grasses, shrubs, and trees, the dunes became permanently stabilized -- they were no longer "on the march." Once stabilized by vegetation, the dunes began to flatten out. After centuries of creep, rodent activity, and slope wash, the dunes were transformed into an undulating plain.

Today, Duxbury Beach supports nearly 40 species of plant life, forming somewhat parallel zones of vegetation, each zone with an associated animal life. On the ocean side are the littoral and dune communities. Although the littoral community is devoid of vegetation, the dune community supports various forms of vegetation: beach grass, seaside dusty-miller, beach pea, seaside goldenrod, poison ivy, and beach heather. Each life-form living in the particularly inhospitable environment of the dune community has developed a fine degree of adaptation in order to cope with the continually shifting sands, strong seasonal winds, high salt concentration and scarcity of water-environmental factors responsible for the prevention of succession to high life-forms in the exposed dune community.

There are various stages of shrub community adjacent to but in the more sheltered areas behind the dune community. Dominant plants of the shrub community are bayberry, beach plum, and salt spray rose.

At High Pines, the mid-point along the stretch of barrier beach, a forest community may be found. This community is farther inland where there is protection from the harsh environmental forces acting upon the dune community. Here, the pitch pine is the dominant plant.

On the bay side of the beach is a salt marsh community. Dominant plants of this community include eel grass in tidal creeks, saltwater cordgrass in regions of daily inundation, salt meadow grass in regions inundated only by high equinoctal tides, and samphire and sea lavender in mudflat areas.

These parellel zones of vegetative communities support animal populations of muskrats, shrews, beetles, spiders, grasshoppers, terns, sandpipers, swallows, warblers, and herring gulls -- the familiar "Sea Gull." In summer, the barrier beach serves as a resting site for some 21 species of migrating sea birds.

Action of natural forces, such as erosion, deposition, sea level, sand supply and salt spray, that have formed Duxbury Beach still continue. "Nature has never made a permanent beach, and she never will. For a beach is supposed to move. It is supposed to change its shape, thinning out or disappearing altogether in one spot, and perhaps gradually appearing some place else." Duxbury Beach will always be exposed to the forces of nature. And its features will be continually changing.

A Problem of Erosion

In April, 1972, a Boston newspaper article reported: "A slender thread of white sand that runs along the ocean 7 miles from Marshfield to the middle of Plymouth Bay may be doomed to wash into the sea." Another similar 1972 report: "Heavy recreational use and storm erosion on the fragile strip of land that comprises Duxbury Beach may have effectively destroyed the popular beach area."

Beach grass, a hardy but fragile plant, is the primary achoring vegetation of the dunes. It is the destruction of the beach grass by recreational pressure and ensuing erosion by natural forces that threatens Duxbury Beach.

As part of its resistance to the high salinity and dessication of the dune community, the beach grass plant has evolved a thick cuticle which makes it brittle near the base and thus susceptible to breakage. Breakage of one blade may result in death of the whole plant.

The death of a single clump of beach grass, particularly on the crest of a dune, may be enough to set the dune in motion. With a break in the vegetative mat, roots of neighboring vegetation are exposed. As more plants die, the sand will be carried inland, forming deep depressions. Storm waves and winds will further erode the area, and possibly cut through the dune completely, forming a gap, or "blowout."

Thus, the dune system of the barrier beach, stabilized solely by beach grass, proves to be completely intolerant to any passage by vehicle or by man on foot. The hard lower beach is tolerant to vehicles, but even driving vehicles over pure sand breaks up the cohesive surface of the face, allowing greater surface area and thus more sand for waves of the next tide to attack and remove.

When beach grasses are not able to form a complete coverage of the dunes, as from damage or destruction by man or vehicle, winds will carry the exposed sand across the beach and into the marshes and water lying behind the beach. This not only destroys the dunes, but might also, if the sand is of sufficient thickness, smother the marsh grasses and thus destroy the marshes as well. Richard Poole, an active conservationist, states, "Once the stable sand is gone, that is, the sand held down by dune grass, there's nothing to keep winter storms from blowing gaps right through the beach into the inland bay -- and that's irreversible."

This type of destruction began on Duxbury Beach when people first walked and then started driving vehicles over the tops of the dunes, killing the beach grass. By 1973, exposed dunes void of vegetation were being eroded at such a rate that the entire dune height had been lowered. In some areas, dunes were totally eroded. In other areas, dune height had been lowered to such an extent that seasonal storm waters washed through, creating permanent blowouts.

In addition to recreational use of the beach, Duxbury Beach has also been struck by a series of storms, the most serious of which occurred in May, 1967, and February, 1972. Weakened by the loss of vegetation, the dunes have lost tremendous amounts of sand from erosion caused by storms. A trustee of the Duxbury Beach Association said the 1972 storm set back the sand dune erosion prevention program some 5 years. Huge sections of the beach dunes were flattened. The waters of Massachusetts Bay broke through to the bayside in at least 7 places. A foot and a half of sand was washed onto the public parking lot.

A study by Poole in 1969 revealed 3 major points of recreational impact and maximum dune erosion along the barrier beach: 1) around the public parking lot and concession area at the north end, 2) around the private parking area (Duxbury residents only) at the east end of Powder Point Bridge, and 3) in the area where beach buggies frequently cross out onto the active beach. At these 3 points on the beach, nearly 50 percent more sand had been eroded than in those areas along the same transect receiving a minimum recreational pressure. This study also showed one 2-mile section of the barrier beach to have lost almost 35 percent of its dune sand from the combination of intensive recreational use and a series of storms between 1951 and 1964, and the average length of blowouts between the dunes had tripled from 33.2 feet to 91.7 feet. In a one-mile transect of the beach, blowouts had increased from 9 in 1951 to 14 in 1957 and to 19 in 1964. The 9 blowouts in 1951 totaled 298.8 feet in length. The 14 blowouts in 1957 totaled 3 times that distance, and the 19 blowouts in 1964 comprised a total of 1,742.6 feet. Poole said in 1969, "Excessive loss of once stable sand, increased size and frequency of dune blowouts and increasing recreational pressure are cause for ecological, political, and social concern."

Near the parking areas where beachgoers tend to concentrate and at the beach buggy crossover point of the barrier beach, nearly 80 percent of sand there in 1951 had been eroded away by 1972, despite bulldozer attempts to replace it. Where a 50-foot-wide depression existed in 1972 there had been a 15-foot dune 2 years earlier. Other sand dunes 15 to 20 feet high in 1958 had completely disappeared by 1973.

The greater the dune loss, the faster the erosion -- "a geometric progession in reverse." Poole remarks in reference to the effects of the 1972 storm, "last month's northeast storm took an incredible toll in terms of sand loss. We might not have another storm like that in 10 years, but when it does come, significant areas of the beach will be destroyed. At this point, it would take hundreds of thousands of dollars to even think about reversing the destruction going on here." As John Nash, a conservationist and dedicated member of the present Duxbury Beach Study Committee, concluded in 1972, "An ecological crisis has been going on at Duxbury Beach for 15 years, and it's time for man to accommodate the beach, instead of the beach accommodating man."

Duxbury Bay and its salt marshes comprise one of the most productive environments in the world. Each acre of the 1100 acres of marshland infringing Duxbury Bay produces 10 tons of green matter per year - twice the amount yielded by one acre of the richest prairie lands of the U.S. The bay and the marshes provide a nutrient-rich area for fish, shell-fish, waterfowl, shorebirds and mammals. In short, this estuary community is teeming with life. With loss of the dunes on Duxbury's barrier beach, a rich, productive environment will not only be disturbed, but destroyed. "Habitat diversity, aesthetic diversity, and niche diversity are products of the plant life so well adjusted to the situation in the protected bay behind the beach."

Duxbury Beach also serves as a natural breakwater to the homes located along the immediate shores of the inner bay and marshes. If such a protective barrier were destroyed, storm waves of Northeasters would strike, damage, and possibly destroy these homes. "A natural storm barrier, Duxbury Beach provides more property protection than all the seawalls that could be built if cost were no object."

Thus, Duxbury Beach proves to be Duxbury's most valuable natural resource. In addition to serving as a recreational area, it provides an irreplaceable protection to the inner harbor, bay and marshes, and the private property along the immediate shores of this productive and diverse estuarine system.

A Dune Stabilization Program

Initiation of a dune stabilization program for Duxbury Beach goes back to the 1930s. As the first attempt to stabilize the dunes, sand fences were constructed for erosion control. In 1954, a rough road was built on the bay side of the dunes, south of the private parking area for the purpose of keeping beach vehicles off the dunes. By 1961, a new sign with well-defined rules was erected in the parking area, and a summer police patrol was established. In 1963, more systematic efforts at erosion control were made with the construction of snow fencing to guide the movement of sand drifts into eroded gullies, and the use of Christmas trees tied to the snow fencing for greater efficiency in building higher sand dunes.

(To be continued)